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DIALOG(R) File 2:INSPEC

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05935711 INSPEC Abstract Number: B9506-2575-002

Title: MEMS fabrication by Lithography and Reactive Ion Etching (LIRIE)

Author(s): Rangelow, I.W.; Hudek, P.

Author Affiliation: Inst. of Tech. Phys., Kassel Univ., Germany

Journal: Microelectronic Engineering vol.27, no.1-4 p.471-4

Publication Date: Feb. 1995 Country of Publication: Netherlands

CODEN: MIENEF ISSN: 0167-9317

U.S. Copyright Clearance Center Code: 0167-9317/95/\$09.50

Conference Title: Micro- and Nanoengineering 94. International Conference on Micro- and Nanofabrication

Conference Sponsor: Ciba-Geigy; CSEM; Daimler Benz Finds; ETH; et al

Conference Date: 26-29 Sept. 1994 Conference Location: Davos, Switzerland

Language: English Document Type: Conference Paper (PA); Journal Paper (JP)

Treatment: Practical (P); Experimental (X)

Abstract: This paper reports on the development of a technology which will offer the potential to manufacture micro-engines, micro-turbines, micro-sensors, micro-actuators, and electronic circuits onto a single silicon chip. Axes or stators (nonmoving parts) are etched into the initial Si-wafer. The movable parts (rotors, beams, etc.) are prepared from electro-chemically etched Si-membranes with defined thicknesses. Both sides of the Si-membrane are covered with a 1.5 μm SiN/sub x/O/sub y/ layer by a low stress (<70 MP) PECVD-process. After that, all movable parts are created lithographically on the SiN/sub x/O/sub y/ surface. This is followed by dry etching the mono-crystalline Si-membrane down to the SiN/sub x/O/sub y/ sacrificial layer on the back side of the membrane by an RIE-process. This fixes the movable parts to the SiN/sub x/O/sub y/-layer. The wafer with the movable parts is flipped onto the wafer with the already etched axis and then positioned and centred. The SiN/sub x/O/sub y/-sacrificial layer is then dissolved by a chemical wet or vapour etch process. Subsequent bonding with a Pyrex glass wafer seals the parts. (5 Refs)

Subfile: B

Descriptors: lithography; micromechanical devices; plasma CVD coatings; semiconductor technology; sputter etching

Identifiers: micro-engines; micro-turbines; micro-sensors; micro-actuators; electronic circuits; single silicon chip; MEMS fabrication; manufacture; LIRIE; lithography; reactive ion etching; electro-chemically etched wafer; low stress PECVD-process; dry etching; mono-crystalline Si-membrane; SiN/sub x/O/sub y/-sacrificial layer; chemical wet etch; vapour etch; bonding; Pyrex glass wafer seals; Si-SiON

Class Codes: B2575 (Micromechanical device technology); B2550G (Lithography); B2550E (Surface treatment for semiconductor devices)

Chemical Indexing:

Si-SiON int - SiON int - Si int - N int - O int - SiON ss - Si ss - N ss - O ss - Si el (Elements - 1,3,3)

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DIALOG(R) File 2:INSPEC

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06624984 INSPEC Abstract Number: B9708-2575-022

Title: Etching processes for high aspect ratio micro systems technology (HARMST)

Author(s): Kassing, R.; Rangelow, I.W.

Author Affiliation: Inst. of Tech. Phys., Kassel Univ., Germany

Journal: Microsystem Technologies vol.3, no.1 p.20-7

Publisher: Springer-Verlag,

Publication Date: Nov. 1996 Country of Publication: Germany

CODEN: MCTCEF ISSN: 0946-7076

SICI: 0946-7076(199611)3:1L:20:EPHA;1-T

Material Identity Number: F257-97005

Language: English Document Type: Journal Paper (JP)

Treatment: Experimental (X)

Abstract: This paper reports on the development of a dry etching based HARMS-Technology which will offer the potential to manufacture micro-engines, micro-turbines, microsensors, micro-actuators, and electronic circuits onto a single silicon IC chip. This technology is based on the highly anisotropic and selective dry etching of Si-monocrystals. The suitability of reactive ion etching for the fabrication of micro electro mechanical systems (MEMS) has been evaluated by characterising the change of lateral dimensions vs. depth in etching deep structures in silicon. Fluorine, chlorine and bromine containing gases have provided the basis for this investigation. A conventional planar RIE (Reactive Ion Etching) reactor has been used, in some cases with magnetic field enhancement or ICP (Inductive Coupled Plasma) Source and low substrate temperature. For reactive ion etching based on $\text{Cl}/\text{sub } 2/$ or $\text{Cl}/\text{sub } 2//\text{HBr}$ plasma a slightly "positive" (top wider than bottom) slope is achieved when etching structures with a depth of several 10 μm , whereas a "negative" slope is obtained when etching with an $\text{SF}/\text{sub } 6//\text{CCl}/\text{sub } 2/\text{F}/\text{sub } 2/$ based plasma. Pattern transfer with vertical walls is obtained for reactive ion etching based on $\text{SF}/\text{sub } 6/$ (with $\text{O}/\text{sub } 2/$, added) when maintaining the substrate at low temperature (in range approximately -100 degrees C). Further optimisation of plasma chemistries and reactive ion etching procedures should result in runouts in the order of 0.1 $\mu\text{m}/100 \mu\text{m}$ depth in Si as well as in organic materials. Etching processes for HARMST is demonstrated in the realisation in Si microturbine. Axes or stators (nonmoving parts) are etched into the initial Si-wafer. The movable parts (rotors, beams, etc.) are prepared from electro-chemically etched Si-membranes with defined thicknesses that, all movable parts are created lithographically on the $\text{SiN}/\text{sub } x/\text{O}/\text{sub } y/$ surface. This is followed by dry etching the monocrystalline Si-membrane down to the $\text{SiN}/\text{sub } x/\text{O}/\text{sub } y/$ sacrificial layer on the back side of the membrane by an RIE-process. The wafer with the movable parts is flipped onto the wafer with the already etched axis and then positioned and centred. The $\text{SiN}/\text{sub } x/\text{O}/\text{sub } y/$ -sacrificial layer is then dissolved by a chemical wet or vapour etch process. Subsequent bonding with a Pyrex glass wafer seals the parts. (27 Refs)

Subfile: B

Descriptors: elemental semiconductors; micromechanical devices; silicon; sputter etching

Identifiers: plasma chemistry; high aspect ratio micro systems technology; HARMST; lithography; electrochemically etched membrane; $\text{SiN}/\text{sub } x/\text{O}/\text{sub } y/$ sacrificial layer; LIRIE; anisotropic selective dry etching; silicon monocrystal; micro electro mechanical system; reactive ion etching; MEMS; planar RIE reactor; magnetic field; ICP source; microturbine; Si

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Class Codes: B2575 (Micromechanical device technology); B2550E (Surface treatment for semiconductor devices)

Chemical Indexing:

Si sur - Si el (Elements - 1)

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DIALOG(R) File 2:INSPEC

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06756388 INSPEC Abstract Number: B9801-2340E-001

Title: A novel in situ vacuum encapsulated lateral field emitter triode

Author(s): Cheol-Min Park; Moo-Sup Lim; Min-Koo Han

Author Affiliation: Sch. of Electr. Eng., Seoul Nat. Univ., South Korea

Journal: IEEE Electron Device Letters vol.18, no.11 p.538-40

Publisher: IEEE,

Publication Date: Nov. 1997 Country of Publication: USA

CODEN: EDLEDZ ISSN: 0741-3106

SICI: 0741-3106(199711)18:11L:538:NSVE;1-R

Material Identity Number: I338-97011

U.S. Copyright Clearance Center Code: 0741-3106/97/\$10.00

Document Number: S0741-3106(97)08108-1

Language: English Document Type: Journal Paper (JP)

Treatment: New Developments (N); Practical (P); Experimental (X)

Abstract: We have designed and fabricated a novel lateral field emitter triode, which is in situ vacuum encapsulated so that any troublesome additional vacuum sealing process is not required. The device exhibits low turn-on voltage of 7 V, stable current density of 2 μ A per tip, and high transconductance of 1.7 μ S per 100 tips field emitter array at $V_{\text{sub}}/AC = 22$ V. An in situ vacuum encapsulation employing recessed cavities by isotropic RIE (reactive ion etch) method and an electron beam evaporated molybdenum vacuum seal are implemented to fabricate the new field emitter triode. The superb field emitter characteristics are probably due to sub-micron dimension device structure and the pencil type lateral cathode tip employing upper and lower LOCOS oxidation. (8 Refs)

Subfile: B

Descriptors: electron field emission; encapsulation; oxidation; seals (stoppers); semiconductor device packaging; sputter etching; vacuum microelectronics; vacuum techniques

Identifiers: lateral field emitter triode; in situ vacuum encapsulation; low turn-on voltage; current density; high transconductance; field emitter array; recessed cavities; isotropic RIE; electron beam evaporated Mo vacuum seal; field emitter characteristics; submicron dimension device structure; pencil type lateral cathode tip; LOCOS oxidation; 7 V; 1.7 μ S; 22 V; $\text{SiO}_2/\text{Si}_3\text{N}_4/\text{Si}$; Mo

Class Codes: B2340E (Vacuum microelectronics); B2320 (Electron emission, materials and cathodes); B0170J (Product packaging); B2550E (Surface treatment for semiconductor devices)

Chemical Indexing:

SiO_2 - Si_3N_4 -Si int - Si_3N_4 int - SiO_2 int - Si3 int - N4 int - O2 int - Si int - N int - O int - Si_3N_4 bin - SiO_2 bin - Si3 bin - N4 bin - O2 bin - Si bin - N bin - O bin - Si el (Elements - 2,2,1,3)

Mo int - Mo el (Elements - 1)

Numerical Indexing: voltage 7.0E+00 V; conductance 1.7E-06 S; voltage 2.2E+01 V

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DIALOG(R)File 2:INSPEC

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06098327 INSPEC Abstract Number: B9512-2550G-108

Title: Bulk micromachining of Si by lithography and reactive ion etching (LIRIE)

Author(s): Rangelow, I.W.; Hudek, P.; Shi, F.

Author Affiliation: Inst. of Tech. Phys., Kassel Univ., Germany

Journal: Vacuum vol.46, no.12 p.1361-9

Publication Date: Dec. 1995 Country of Publication: UK

CODEN: VACUAV ISSN: 0042-207X

U.S. Copyright Clearance Center Code: 0042-207X/95/\$9.50+.00

Language: English Document Type: Journal Paper (JP)

Treatment: Practical (P); Experimental (X)

Abstract: This paper reports on the development of a technology which will offer the potential to manufacture micro-engines, micro-turbines, micro-sensors, micro-actuators and electronic circuits onto a single silicon chip. This technology is based on the highly anisotropic and selective dry etching of Si-monocrystals. Axes or stators (non-moving parts) are etched into the initial Si-wafer. The movable parts (rotors, beams, etc.) are prepared from electro-chemically etched Si-membranes with defined thicknesses. Both sides of the Si-membrane are covered with a 1.5 μ m SiN/sub x/O/sub y/ layer by a low stress (<10 MP) PECVD-process. After that, all movable parts are created lithographically on the SiN/sub x/O/sub y/ surface. This is followed by dry etching the mono-crystalline Si-membrane down to the SiN/sub x/O/sub y/ sacrificial layer on the reverse side of the membrane by an RIE-process. This fixes the movable parts to the SiN/sub x/O/sub y/-layer. The wafer with the movable parts is flipped onto the wafer with the already etched axis and then positioned and centred. The SiN/sub x/O/sub y/-sacrificial layer is then dissolved by a chemical wet or vapour etch process. Subsequent bonding with a Pyrex glass wafer seals the parts. (20 Refs)

Subfile: B

Descriptors: elemental semiconductors; lithography; micromachining; silicon; sputter etching

Identifiers: Si; lithography; reactive ion etching; bulk micromachining; micro-engines; micro-turbines; micro-sensors; micro-actuators; electronic circuits; axes; stators; PECVD; dry etching; dissolving; Pyrex glass wafer bonding; 1.5 μ m

Class Codes: B2550G (Lithography); B2550E (Surface treatment for semiconductor devices); B2575 (Micromechanical device technology); B2520C (Elemental semiconductors)

Chemical Indexing:

Si sur - Si el (Elements - 1)

Numerical Indexing: size 1.5E-06 m

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DIALOG(R) File 2:INSPEC

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06613112 INSPEC Abstract Number: B9708-2575-004

Title: Micromachined flat-walled valveless diffuser pumps

Author(s): Olsson, A.; Enoksson, P.; Stemme, G.; Stemme, E.

Author Affiliation: Dept. of Signals, Sensors & Syst., R. Inst. of Technol., Stockholm, Sweden

Journal: Journal of Microelectromechanical Systems vol.6, no.2 p. 161-6

Publisher: IEEE,

Publication Date: June 1997 Country of Publication: USA

CODEN: JMIYET ISSN: 1057-7157

SICI: 1057-7157(199706)6:2L:161:MFVV;1-K

Material Identity Number: 0938-97002

U.S. Copyright Clearance Center Code: 1057-7157/97/\$10.00

Document Number: S1057-7157(97)03320-9

Language: English Document Type: Journal Paper (JP)

Treatment: Experimental (X)

Abstract: The first valveless diffuser pump fabricated using the latest technology in deep reactive ion etching (DRIE) is presented. The pump was fabricated in a two-mask micromachining process in a silicon wafer polished on both sides, anodically bonded to a glass wafer. Pump chambers and diffuser elements were etched in the silicon wafer using DRIE, while inlet and outlet holes are etched using an anisotropic etch. The DRIE etch resulted in rectangular diffuser cross sections. Results are presented on pumps with different diffuser dimensions in terms of diffuser neck width, length, and angle. The maximum pump pressure is 7.6 m H/sub 2/O (74 kPa), and the maximum pump flow is 2.3 ml/min for water. (15 Refs)

Subfile: B

Descriptors: diffusion pumps; micromachining; micropumps; sputter etching

Identifiers: flat-walled valveless diffuser pump; deep reactive ion etching; two-mask micromachining; silicon wafer; anisotropic etching; fabrication; 74 kPa; Si

Class Codes: B2575 (Micromechanical device technology)

Chemical Indexing:

Si el (Elements - 1)

Numerical Indexing: pressure 7.4E+04 Pa

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DIALOG(R) File 2:INSPEC

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06316279 INSPEC Abstract Number: B9608-2575-106, C9608-3260G-007

Title: An improved valve-less pump fabricated using deep reactive ion etching

Author(s): Olsson, A.; Enoksson, P.; Stemme, G.; Stemme, E.

Author Affiliation: Dept. of Signals, Sensors & Syst., R. Inst. of Technol., Stockholm, Sweden

Conference Title: Proceedings. IEEE, The Ninth Annual International Workshop on Micro Electro Mechanical Systems. An Investigation of Micro Structures, Sensors, Actuators, Machines and Systems (Cat. No.96CH35856)

p.479-84

Publisher: IEEE, New York, NY, USA

Publication Date: 1996 Country of Publication: USA xxiv+530 pp.

ISBN: 0 7803 2985 6 Material Identity Number: XX96-00338

U.S. Copyright Clearance Center Code: 0 7803 2985 6/96/\$5.00

Conference Title: Proceedings of Ninth International Workshop on Micro Electromechanical Systems

Conference Sponsor: IEEE Robotics & Autom. Soc

Conference Date: 11-15 Feb. 1996 Conference Location: San Diego, CA, USA

Language: English Document Type: Conference Paper (PA)

Treatment: Practical (P); Experimental (X)

Abstract: We present the first valve-less diffuser pump fabricated using the latest technology in deep reactive ion etching (DRIE). The pump is fabricated in a simple micromachining process in a double side polished silicon wafer anodically bonded to a glass wafer. Pump chambers and diffuser elements are etched in the silicon wafer using DRIE while inlet and outlet holes are etched using an anisotropic KOH-etch. The DRIE etch resulted in rectangular diffuser cross-sections. We present results on pumps with different diffuser dimensions in terms of diffuser neck width, length and angle. We reached a maximum pump pressure of 7.6 m H/sub 2/O (74 kPa) and maximum pump flow of 2.3 ml/min for water. (15 Refs)

Subfile: B C

Descriptors: fluidic devices; micromachining; micropumps; sputter etching

Identifiers: valve-less diffuser pump fabrication; deep reactive ion etching; micromachining process; double side polished Si wafer; anodic bonding; glass wafer; pump chambers; diffuser elements; anisotropic KOH-etch; rectangular diffuser cross-sections; diffuser neck width; diffuser length; diffuser angle; maximum pump pressure; maximum pump flow; methanol; water; 74 kPa; Si

Class Codes: B2575 (Micromechanical device technology); B2550E (Surface treatment for semiconductor devices); C3260G (Hydraulic and pneumatic control equipment)

Chemical Indexing:

Si sur - Si el (Elements - 1)

Numerical Indexing: pressure 7.4E+04 Pa

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08937494 INSPEC Abstract Number: A2004-11-0710C-045, B2004-05-2575F-208

Title: Incrementally etched electrical feedthroughs for wafer-level transfer of glass lid packages

Author(s): Oberhammer, J.; Stemme, G.

Author Affiliation: Dept. of Signals, Sensors & Syst., R. Inst. of Technol., Stockholm, Sweden

Conference Title: TRANSDUCERS '03. 12th International Conference on Solid-State Sensors, Actuators and Microsystems. Digest of Technical Papers (Cat. No.03TH8664) Part vol.2 p.1832-5 vol.2

Publisher: IEEE, Piscataway, NJ, USA

Publication Date: 2003 Country of Publication: USA 2 vol.(xl+xxxix+1938) pp.

ISBN: 0 7803 7731 1 Material Identity Number: XX-2003-02412

U.S. Copyright Clearance Center Code: 0-7803-7731-1/03/\$17.00

Conference Title: IEEE International Solid-State Sensors and Actuators Conference

Conference Sponsor: IEEE; Electron Devices Soc

Conference Date: 8-12 June 2003 Conference Location: Boston, MA, USA

Medium: Also available on CD-ROM in PDF format

Language: English Document Type: Conference Paper (PA)

Treatment: Practical (P); Experimental (X)

Abstract: This paper reports on a simple fabrication technique to create full wafer-level transferred glass-lid encapsulations for near-hermetic packaging of MEMS devices using adhesive wafer bonding with Benzocyclobutene. Furthermore, a new technique to create low-density feedthroughs through the glass wafer for electrical interconnections from the back to the front side of the glass-lids is introduced. The through-wafer vias are fabricated by combining a mechanical etch-step by powder-blasting from the back side and a subsequent short hydrofluoric acid wet etch step. The advantage of this via technique is that the major part of the via is etched without going completely through the wafer, allowing standard surface micromachining processes on the front side of the glass wafer before the final opening of the via. (10 Refs)

Subfile: A B

Descriptors: adhesive bonding; encapsulation; glass; interconnections; micromachining; micromechanical devices; packaging; sputter etching; wafer bonding

Identifiers: glass lid packages; wafer-level transferred glass-lid encapsulations; hermetic packaging; MEMS devices; adhesive wafer bonding; benzocyclobutene; electrical interconnections; powder-blasting; hydrofluoric acid wet etching; surface micromachining

Class Codes: A0710C (Micromechanical devices and systems); A8160F (Surface treatment and degradation of glasses); A5275R (Plasma applications in manufacturing and materials processing); B2575F (Fabrication of micromechanical devices); B0170J (Product packaging)

Chemical Indexing:

SiO2 int - O2 int - Si int - O int - SiO2 ss - O2 ss - Si ss - O ss

(Elements - 2)

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